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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A61L 15/32, 15/40, 15/42

A2

(11) International Publication Number: WO 98/22154

(43) International Publication Date: 28 May 1998 (28.05.98)

(21) International Application Number: PCT/US97/21052

(22) International Filing Date: 12 November 1997 (12.11.97)

(30) Priority Data:
08/754,818 21 November 1996 (21.11.96) US

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(81) Designated States: AU, CA, JP, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: BIOPOLYMER FOAMS FOR USE IN TISSUE REPAIR AND RECONSTRUCTION

(57) Abstract

Single and double density biopolymer foams, composite biopolymer foams including both single and double density foams, and methods of preparing these foams and composite foams are described. Also described are biocompatible constructs which include single or double density biopolymer foams and extracellular matrix particulates and methods of preparing these constructs. The foams, composite foams, and biocompatible constructs of the invention can be used in tissue repair and reconstruction.

less than about 10 μm. Preferred biopolymers for use in double density foams are described herein. In other embodiments, the double density biopolymer foams can include extracellular matrix particulates and/or cells.

Double density biopolymer foams of the invention can be prepared by forming a biopolymer solution and then crosslinking the biopolymer in the biopolymer solution. The biopolymer solution can then be freeze-dried to form a foam, hydrated, and shaped to have a selected form. The foam having the selected form can then be dried to yield the double density biopolymer foam. In another embodiment, the crosslinking step occurs after the freeze-drying step. In a preferred embodiment, the method for preparing double density biopolymer foams includes, prior to the crosslinking step, the step of polymerizing the biopolymer in the biopolymer solution to form a biopolymer lattice. The invention also pertains to double density biopolymer foams prepared by this method.

Composite biopolymer foams which include both single and double density foams are also specifically contemplated by the invention. The foams or composite foams can further be conditioned with cells prior to use *in vitro* or *in vivo*. Composite biopolymer foams are formed by first providing a double density biopolymer foam and then hydrating the double density biopolymer foam with, for example, water or a biopolymer solution. A biopolymer solution is then added to the hydrated double density biopolymer foam and the solution and hydrated double density foam are freeze-dried to form a composite biopolymer foam. Prior to the freeze-drying step, the biopolymer in the biopolymer foam can be crosslinked. The invention also includes composite biopolymer foams prepared by this method. The single density and double density foams of the composite biopolymer foam can also be freeze-dried after cell conditioning.

In another aspect, the invention pertains to biocompatible constructs which include single or double density biopolymer foams and extracellular matrix particulates. The extracellular matrix particulates can be dispersed throughout the foam, e.g., the extracellular matrix particulates are included within in a biopolymer solution or suspension which is dispersed throughout the foam and/or which is coated on the surface of the biopolymer foam. The biopolymer foam with the extracellular matrix particulates can then be freeze-dried.

In yet another aspect, the invention pertains to methods for preparing biopolymer-coated, e.g., collagen-coated, single or double density foams. These methods include preparing the single or double density foams by the methods described herein and then applying a biopolymer solution, which can further include extracellular